

**BIOLOGY  
HIGHER LEVEL  
PAPER 2**

Thursday 10 November 2005 (afternoon)

2 hours 15 minutes

Candidate session number

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**INSTRUCTIONS TO CANDIDATES**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

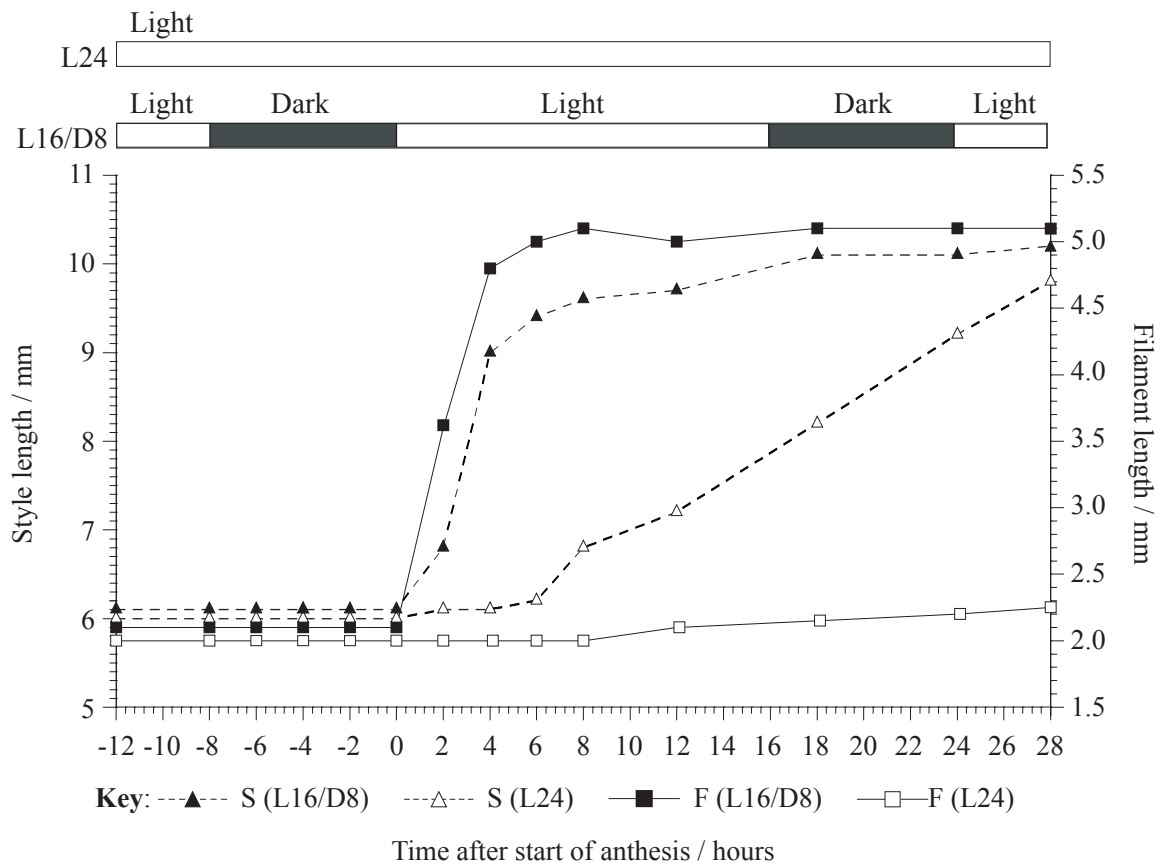


## SECTION A

Answer **all** the questions in the spaces provided.

- In order to prevent transfer of pollen from an anther of one plant to the stigma of the same plant (self-pollination), the sunflower (*Helianthus spp*) anther sheds its pollen before the stigma is mature enough to receive it. Early in the morning the anther is exposed by elongation of the filaments. The anthers open at this time to release their pollen (anthesis). The stigma appears above the anthers by late afternoon, and by the following morning it is fully receptive.

To see how the filament (F) and the style (S) are affected by light, their lengths were measured at time intervals starting 12 hours before anthesis (–12). Some plants were grown in continuous white light (L24) and some plants grown under cycles of 16 hours white light followed by 8 hours dark (L16/D8). The results are shown in the graph.



[Source: Lobello *et al.*, *Journal of Experimental Botany*, (2000), **51**, pages 1403–1412]

- Filaments of the plants grown in continuous white light increased in length by 0.25 mm in the 28 hours after anthesis. Calculate how much the filaments of the plants grown in alternating white light and dark increased during the same period.

[1]

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*(Question 1 continued)*

- (b) Compare the increase in the length of the style in the plants grown in continuous white light with those grown in alternating white light and dark. [2]

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The table compares the percentage of ovules that have been fertilized and developed into seeds in sunflower plants grown under continuous white light with those grown under alternating light and dark. The numbers represent the mean  $\pm$  one standard deviation.

Light treatments	Percentage of fertilized ovules
Continuous white light (L24)	11.40 $\pm$ 7.76
Alternating light and dark (L16/D8)	58.26 $\pm$ 4.06

- (c) Explain the differences in the percentages of ovules fertilized using the data in the graph about the growth of filaments and styles. [3]

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- (d) Explain how standard deviation (SD) shown in this table can be used to help in comparing the effect of light treatments on the fertilization of ovules. [3]

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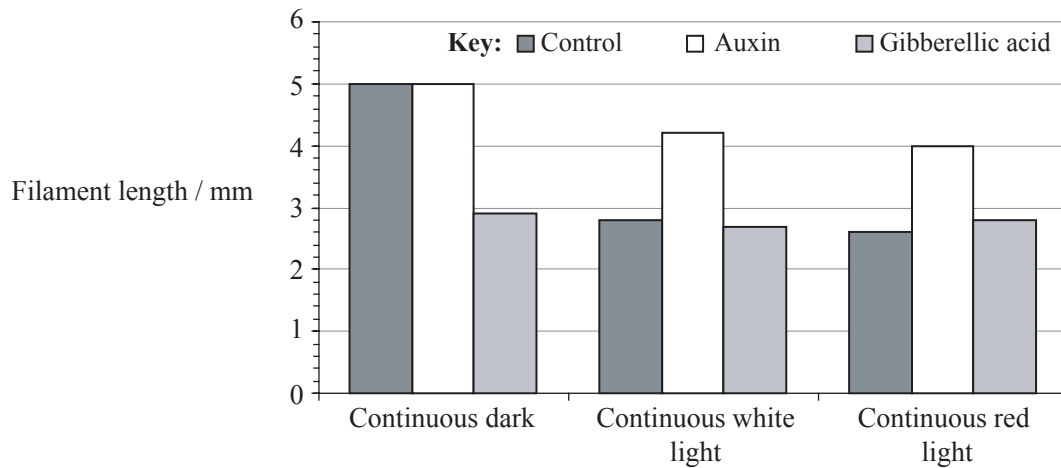
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(Question 1 continued)

To analyse the effect of growth regulators on filament elongation, further experiments were performed in the dark, white light and red light. The flowers were treated with auxin or with gibberellic acid and compared to a control with no growth regulator. The results are shown in the bar chart below.



- (e) Identify, with reasons, which factors promote and which factors inhibit the elongation of filaments. [3]

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- (f) Explain the disadvantages to a plant of self-pollination. [2]

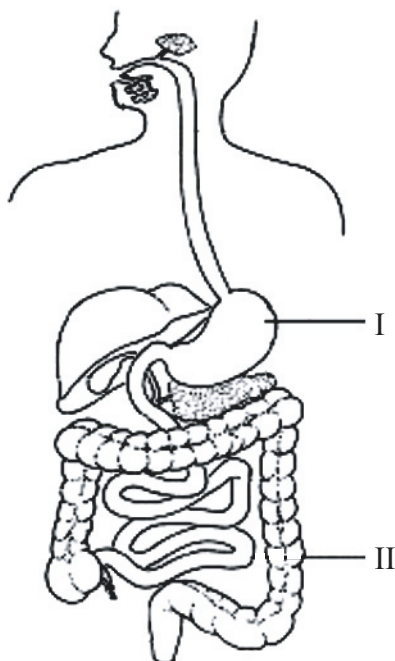
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2. The following is a diagram of the human digestive system.



- (a) State the name and **one** function for each of the labelled parts. [2]

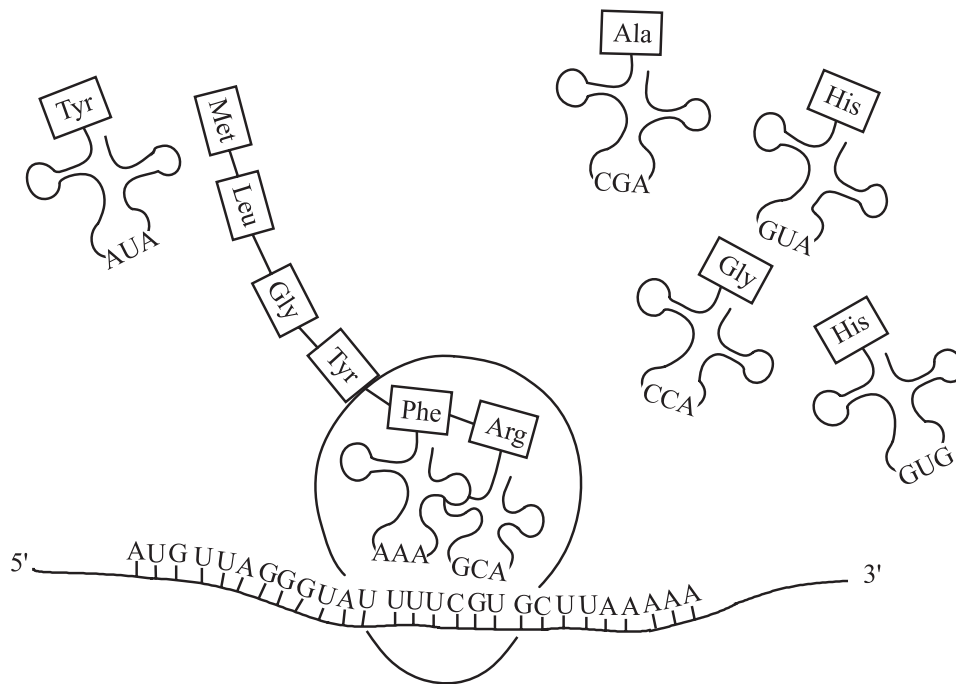
I: Name: .....  
 Function: .....  
 II: Name: .....  
 Function: .....

- (b) Annotate the diagram to show which structures secrete amylase. [2]

- (c) Explain how the structure of the villi in the small intestine are related to absorption of digested food. [3]

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3. The information needed to make polypeptides is carried in the mRNA from the nucleus to the ribosomes of eukaryotic cells. This information is decoded during translation. The diagram below represents the process of translation.



**Key:**

Tyr = Tyrosine  
Met = Methionine  
Leu = Leucine

Ala = Alanine  
Gly = Glycine  
His = Histidine  
Phe = Phenylalanine

- (a) Annotate the diagram to show the direction in which the ribosome moves during translation. [1]

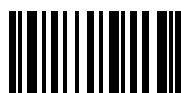
- (b) State the name of the next amino acid which will attach to the polypeptide. [1]

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- (c) Explain how the amino acid was attached to the tRNA. [3]

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*(Question 3 continued)*

- (d) Identify **two** locations within a eukaryotic cell where translation occurs. [1]

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4. Organisms in a community need a supply of energy. This energy is trapped by photosynthesis and then flows through a food web. The organisms in the food web lose energy in various ways, including excretion. All the energy is eventually lost as heat.

- (a) (i) State **one** excretory product of mammals. [1]

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- (ii) State the need for excretion in all living organisms. [1]

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- (b) Outline the difference in absorption of red, blue and green light by chlorophyll for the process of photosynthesis. [1]

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- (c) Explain the role of saprotrophic organisms (decomposers) in recycling nutrients. [2]

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**SECTION B**

*Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

5. (a) Explain the reactions that occur in the matrix of the mitochondrion that are part of aerobic respiration. [8]
- (b) Outline the differences between aerobic and anaerobic respiration. [4]
- (c) The process of respiration involves many enzyme catalysed reactions. Describe what would happen to these enzymes if they were exposed to increasing temperatures. [6]
6. (a) Draw a labelled diagram of the structure of an ovary as seen using a light microscope. [5]
- (b) Outline the process of fertilization in humans. [5]
- (c) Explain the cause, transmission and social implication of AIDS. [8]
7. (a) Explain how the nerve impulse passes along a neuron. [8]
- (b) Outline the general organization of the nervous system. [4]
- (c) Polio is a viral disease which affects the nervous system. Describe the different ways in which the body could acquire immunity to this disease. [6]
8. (a) Define the term *gene linkage* and outline an example of a cross between two linked genes. [8]
- (b) Describe the inheritance of ABO blood groups including an example of the possible outcomes of a homozygous blood group A mother having a child with a blood group O father. [5]
- (c) Outline sex linkage. [5]

